PATENT ABSTRACTS OF JAPAN

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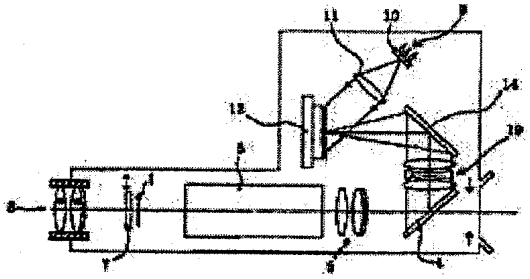
(54) STEREOSCOPIC MICROSCOPE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a stereoscopic microscope, specially, a microscope for surgical operation which can vary the display area and display power of another image in the observation view field of a microscope image and also change the center position of the microscope image.
SOLUTION: This microscope is provided with a wavelength-limiting filter 7 which is provided nearby the image formation position of the microscope image I so that it can be inserted into and extracted from the optical path, an image display element 12, an optical path composing means 4 which puts the luminous flux from the image display element 12 together with the microscope optical path, an image forming lens 5 which images the light from the image element 12 at the position of the microscope image I, and an ocular 8 for enlarging and observing the microscope image I and another image displayed on the image display element 12 through the wavelength limiting filter 7. A projection optical system which projects the luminous flux from the image display element 12 on the optical path composing means 4 includes a zoom optical system 19, which is operated in relation with the insertion and extraction of the wavelength limiting filter 7.



CLAIMS

[Claim(s)]
[Claim 1]A stereoscopic microscope which intercept a partial area of a shape of microscopic features, and said other pictures are displayed in a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, and is characterized by making it change area of said intercepted field.
[Claim 2]A stereoscopic microscope characterized by having displayed on said intercepted field, and also having intercepted a partial area of a shape of microscopic features, and having displayed said other pictures in a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, and making it change a size of a picture.
[Claim 3]In a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, A display device and a projection optical system which display said other pictures apart from an optical system of a microscope are established, A stereoscopic microscope having inserted other pictures of this projection optical system into a view of said microscope optical system, and also having had a picture inserting member, and having a moving mechanism to which these other picture inserting members are moved in an optical path of said microscope optical system.
[Claim 4]In a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, A stereoscopic microscope, wherein a display device and a projection optical system which display said other pictures apart from an optical system of a microscope were established, it had an optical-path composite member which combines an optical path of this projection optical system with an optical path of said microscope optical system and said projection optical system is provided with a variable power optical system.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a suitable operating microscope to display simultaneously other pictures, such as a stereoscopic microscope especially an endoscope image used together at the time of an operation, MRI before an operation and CT image, and a nerve monitor waveform signal, in the same view.
[0002]
[Description of the Prior Art]Conventionally, the operating microscope was used for surgical operations, such as a neurosurgery, otorhinolaryngology, and ophthalmology, provided the observer with the magnified observation image of the operating area, and has played the role important for the improve efficiency of an operation, etc. In recent years, in order to perform an operation on low invasion more, for endoscope observation to be used together by the operation which was being conventionally conducted only by the operating microscope observation lower, and to be able to observe simultaneously operating microscope observation images and an endoscope observation image is desired. There are a picture of MRI, a CT image, etc. before an operation and a request that there is a request referred to as liking to observe simultaneously with a microscope image and also it is made to like to be able to check a nerve monitor signal etc. within the same view.
[0003]Conventionally, what was indicated by JP,H10-333047,A as what meets these demands is known. Drawing 30 shows the important section composition of the example. In this conventional example, the endoscope image transmitted via the prism P which was displayed on the image display means D, such as small LCD, and was inserted into the projection optical system PO and the view of a microscope, and the optical image of a microscope can be simultaneously observed now through eyepiece IP of a microscope. In this case, a part of microscope image is missing, and an endoscope image is displayed on that lack position. Hereafter, this displaying condition will be called "a picture yne display." Drawing 31 shows the important section composition of other examples. In this conventional example, endoscope image RI_1, way previous image RI_2, such as MRI, and nerve monitor waveform RI_3 are displayed side by side on the image display means D, and these are inserted into the microscopic field via the projection optical system PO containing the prism P, and it is made to indicate by picture yne. Drawing 32 shows the important section composition of the example of further others. With the picture yne display which can observe simultaneously with a microscope image endoscope image RI_1, nerve monitor waveform RI_3, etc. which were displayed on the display D through eyepiece IP of a microscope in this conventional example via the mirror M in which it was inserted into the projection optical system PO and the microscopic field. Signs that the double image of the nerve monitor waveform RI_3 displayed on the image display device D was carried out to the microscope image via the half mirror HM are shown. Nerve monitor waveform RI_3 is compounded using the half mirror HM, in order to hardly lose the picture information of a microscope, even if it carries out a double image to a microscope image. Hereafter, this double image display will be called a "screen overlay."
[0004]
[Problem(s) to be Solved by the Invention]By the way, in undergoing an operation by using a microscope and an endoscope together, the picture which a way person wants to acquire according to advance of an operation changes. Namely, although the viewing area of an endoscope would be enlarged and he would like to expand and come to also see an endoscope image in the scene where replace with the operation under a microscope and the operation by an endoscope takes the lead, It seems that it can be said in the above-mentioned conventional image display method that an endoscope image is expanded, securing the visual field center picture of a microscope since the center of the microscopic field will disappear if a viewing area is enlarged. It is desirable to advance an operation, checking CT and MR imaging of a way previous image within the same view in addition to a shape of microscopic features. Namely, since CT and MR imaging are fault pictures, display two or more pictures, recognize the position of a tumor, or. It is required to use properly according to the scene of the operation performed [using the display of one sheet and securing the view of a microscope and], and to enable it to change the size of the viewing area of other pictures, such as CT and MR imaging, for this reason is desired. However, in the above-mentioned conventional method of presentation, only whether other pictures' being put in in the observation visual field of a microscope image and that selection which is not put in can be performed, and the size of the viewing area of other pictures cannot be changed.
[0005]The place which this invention is made in view of the such problem which a Prior art has, and is made into the purpose, Into the observation visual field of a microscope image, the display surface product of other pictures can

be changed suitably, and it is going to provide a stereoscopic microscope suitable as an operating microscope which the display magnification can also be changed and can change the center position of a microscope image.
[0006]
[Means for Solving the Problem]To achieve the above objects, a stereoscopic microscope by this invention, In a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, intercept a partial area of a shape of microscopic features, and said other pictures are displayed, and it is characterized by making it change area of said intercepted field.
[0007]In a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, a stereoscopic microscope by this invention intercepts a partial area of a shape of microscopic features, and displays said other pictures, and. It displays on said intercepted field, and also is characterized by making it change a size of a picture.
[0008]In a stereoscopic microscope with which a stereoscopic microscope by this invention observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, It is characterized by having established a display device and a projection optical system which display said other pictures apart from an optical system of a microscope, having inserted other pictures of this projection optical system into a view of said microscope optical system, and also having had a picture inserting member, and having a moving mechanism to which these other picture inserting members are moved in an optical path of said microscope optical system.
[0009]In a stereoscopic microscope with which a stereoscopic microscope by this invention observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, It is characterized by having established a display device and a projection optical system which display said other pictures apart from an optical system of a microscope, having had an optical-path composite member which combines an optical path of this projection optical system with an optical path of said microscope optical system, and providing said projection optical system with a variable power optical system.
[0010]
[Embodiment of the Invention]Hereafter, it explains based on working example illustrating an embodiment of the invention. In each working example, identical codes are given to a member and a portion same in a parenchyma top, and those overlapping explanation is omitted.
The sectional view showing the basic constitution of the optical system of the optical operating microscope which working example 1 drawing 1 requires for this invention, the fragmentary sectional view showing the modification of the optical system which showed drawing 1 drawing 2, and drawing 3 are the important section sectional views of the 1st working example of this invention, and are a figure equivalent to the left side view of the portion surrounded with the dashed line of drawing 1. In drawing 1 and 2, 1 stops down an object lens and 2 extracts a zoom lens and 3 (not arranged), An image rotator, and for 6 erection-ize direction of an image and 7 have been arranged to an optical path at the position which is abbreviated-in agreement with the microscope image I, enabling free insertion and detachment, and also an eyepiece and S are observation objects the wavelength limiting filter as a picture inserting member, and 8. [4] [an optical-path composite member] [5] [an image formation lens] In drawing 3, 9 a light source and 10 an optical diffusion board and 11 A collimating lens, 12 DMD as an image display element (Digital MicromirrorDevice - element which can modulate a luminosity by arranging a minute micro mirror (the number of sizes 10 microns) to matrix form, and controlling the angle of inclination of each micro mirror), 13 is a projection lens and 14 is a mirror.
[0011]The optical-path composite member 4 is a synthetic mirror which has a penetration belt of three kinds of **** of the **** zone shown in drawing 4. Only the portion 7a (refer to drawing 5) corresponding to the portion by which a picture yne indication of others and the picture (pictures other than a microscope image) should be given when the wavelength limiting filter 7 is inserted into an optical path has the **** transmissivity characteristic shown in drawing 6 (a), The other portion 7b is constituted so that it may have the transmissivity of 100% for it to be shown in drawing 6 (b). The light source 9 comprises three light emitting diodes etc. which emit three kinds of lights, i.e., the red light, green light, and blue glow of **** wavelength of the **** zone shown in drawing 7, respectively, and constitutes an image display means with DMD12.
[0012]Since this example is constituted as mentioned above, the light from the observation object S illuminated by the publicly known lighting system which is not illustrated, When the object lens 1, the zoom lens 2, the optical-path composite member 4, the image formation lens 5, the image rotator 6, and the wavelength limiting filter 7 are inserted into the optical path, this wavelength limiting filter 7 is penetrated, The erection-ized microscope image I is formed and magnified observation of this microscope image I is carried out through the eyepiece 8. In this case, since the light from the observation object S has a large wavelength range, when penetrating the optical-path composite member 4, even if it decreases by a narrow band, the transmitted light amount as the whole hardly becomes less. On the other hand, it is uniformly mixed with the optical diffusion board 10, and each colored light emitted from the light source 9 is made into a parallel beam with the collimating lens 11, and is made to enter into DMD12. The illuminant light reflected from the minute mirrors of DMD12 controlled corresponding to the other pictures by which it should be indicated by picture yne, The projection lens 13 is penetrated, and it is reflected by the mirror 14, and is compounded by the microscopic optical path by the optical-path composite member 4, image formation is carried out to the position of the microscope image I as other pictures via the image formation lens 5 and the image rotator 6, and magnified observation of this is carried out with the microscope image I via the eyepiece 8.
[0013]In this case, since the optical-path composite member 4 has the penetration characteristic like the above, it

reflects the catoptric light from DMD12 efficiently, and can compound it to a microscopic optical path. Since only the light from DMD12 is penetrated in some wavelength limiting filters 7 7a and the light of the other wavelength band is intercepted, brightly, a boundary with a microscope image is clear, and also ** can obtain the picture yne display of a picture (refer to drawing 8). Since the wavelength limiting filter 7 is selected by the size which covers the whole microscopic field, it can lose hard to see [of the view in the focus gap within the view produced when it inserts only in the required part within a view, or an edge part]. If it is displayed by DMD12 since the wavelength limiting filter 7 is constituted so that it can insert and detach to an optical path, and also the size of a picture and the insertion amount into the optical path of the wavelength limiting filter 7 place it as they interlock, As shown in drawing 9, the always optimal display within a view can be obtained only by choosing the display pattern of other pictures. Become possible, if constituted in this way to display two or more pictures side by side like CT and MR imaging, or to carry out the enlarged display of one of them, and like an endoscope image The size of a viewing area, If magnification when a display image is observed through the eyepiece 8 is changed by proportionality, makes and places, a picture besides **** by an optical zoom can be observed. In working example, although an image display element is a piece, even if plurality is installed side by side and it makes it make it the insertion amount of the wavelength limiting filter 7 interlocked with, respectively, the same effect can be acquired. Although three light emitting diodes are used in this example, it may be made to carry out monochrome Lighting Sub-Division with one light emitting diode. What is necessary is just to double the spectral transmission characteristic of the optical-path composite member 4 and a wavelength limiting filter with the wavelength of a light emitting diode at this time.

[0014]Working example 2 drawing 10 is an important section sectional view of the 2nd working example of this invention. This working example is the point constituted so that it may be compounded by the microscope light flux after high reflective liquid crystal is used as an image display element and the light flux from an image display element penetrates the image rotator 6, and differs from the 1st working example. 15 are an image formation lens with which the focal distance is adjusted so that image formation may be carried out to the position which 17 reflected a condenser and 16 by the polarization mirror, reflected it with high reflective liquid crystal, and the reflected light flux from the high reflective liquid crystal 17 was made to reflect 18 by the polarization mirror 16 and the optical-path composite member 4, and was abbreviated-in agreement with the image formation face of the microscope image I among a figure.

[0015]According to this example, the light of three colors emitted from the light source 9 penetrates the back condenser 15 and the polarization mirror 16 which were equalized with the optical diffusion board 10, and illuminates the surface of the high reflective liquid crystal 17. In this way, it was displayed on the high reflective liquid crystal 17, and also it is reflected by the polarization mirror 16, the catoptric light from a picture is compounded by the microscopic optical path by the crepuscular-rays way composite member 4 which penetrated the image formation lens 18, and image formation is carried out to the position which was abbreviated-in agreement with the image formation face of the microscope image I. Therefore, it was displayed on the high reflective liquid crystal 17, and also as the 1st working example explained, it is indicated by picture yne, and magnified observation of the picture is carried out with a microscope image via the eyepiece 8. Since the operation effect in this case is the same as the 1st working example described, explanation is omitted.

[0016]Although the transmissivity characteristic of the optical-path composite member 4 is as the 1st working example having described, if the characteristic of the portion of this valley can be made into 0% of transmissivity, and 100% of reflectance, the catoptric light from the high reflective liquid crystal 17 can be compounded most efficiently. However, the viewpoint referred to as not breaking down the color reproduction nature of a microscope and also lessening a light volume loss more actually to transmissivity is good to set up to 20% thru/or about 80%. As for 50 nm or less of wavelength intervals, if it can do in half breadth, 20 nm or less is preferred.

[0017]Working example 3 drawing 11 is an important section sectional view of the 3rd working example of this invention. It is indicated by picture yne, and also this working example differs from working example as stated above in change of the display size of a picture being interlocked with and having enabled it to also change the display magnification of other pictures. That is, 19 is a zoom optical system as a projection optical system arranged between DMD12 as an image display element, and the optical-path composite member 4, and it is constituted so that the variable power operation of this zoom optical system 19 and movement of the wavelength limiting filter 7 may synchronize. Therefore, according to this example, it is displayed in the microscopic field, and also as for a picture, magnification and a display surface product may change. Since the operation effect of others of this example is the same as the 1st working example described, explanation is omitted.

[0018]Working example 4 drawing 13 is an important section sectional view showing the 4th working example of this invention. In the 3rd working example, this working example arranges the zoom optical system 19 so that that optic axis may cross with a microscope optic axis and angle deltatheta, It is arranged so that it may come to the position in which it was constituted so that other pictures might carry out image formation to the position from which it separated from the visual field center, and the center position separated from the image display element 12 (17) from the optic axis of the zoom optical system 19. therefore, when variable power operation was performed with this composition, it was displayed on the image display element 12 (17), and also the picture was shown in drawing 12 (a) and (b) — as — the inside of a microscope image — stake **** from outside (starting from X seal) — it may be displayed like. This is useful in especially the scene that needs expansion of display magnification according to expansion of display size like [in case other pictures are endoscope images].

[0019]Working example 5 drawing 14 is an important section sectional view showing the 5th working example of this invention. It is indicated by picture yne, and also this working example is interlocked with change of the display size

of a picture, is the point that the center position of the microscope image was changed, and differs from working example as stated above. The movable declination prism arranged movable on a microscopic optical path in order for 20 to move a microscope optic axis to the optic axis of the eyepiece 8 among a figure, A driving means for 21 to move the wavelength limiting filter 7 and 22 control movement of the wavelength limiting filter 7 via the driving means 21, and they are the drive control means which can control movement of the variable declination prism 20. Therefore, according to this example, by operating the drive control means 22, as shown in drawing 15 (a) and (b), expansion of the viewing area of other pictures can be interlocked with, and a microscope image can be moved. In this case, it is constituted so that that center may move in the direction as for which KERARE does not have a microscope image to the approach direction into the microscope image of other pictures. When the viewing area of other pictures can be enlarged by this, without if possible losing the amount of information of a microscope, improvement in workability can be realized and it applies to especially an operating microscope, since the information on other pictures can be acquired securing a view required for an operation, it is convenient.

[0020]Working example 6 drawing 16 is an important section sectional view showing the 6th working example of this invention. It may be indicated by picture yne, without carrying out a screen overlay or using the wavelength limiting filter 7, this working example changes the display size of a picture, and it is the point of having enabled it to change the center position of a microscope image, and differs from working example as stated above. 23 are a mirror among a figure and prism and 24 a microscope image, Image formation is carried out on DMD12 via the variable declination prism 20 optical-path composite member 4, the image formation lens 5, the image rotator 6, the prism 23, and the mirror 24, On the other hand, after being made uniform with the diffusion board 10, the light of three colors emitted from the light source 9 is compounded by the microscopic optical path via the collimating lens 11, the mirror 14, and the optical-path composite member 4, and as glared in DMD12, it is constituted.

[0021]Since this example is constituted in this way, if DMD12 is changed into the state (ON state) of complete reflection and is observed, without turning on the light source 9, as shown in drawing 17 (a), only the usual microscope image will appear in a view. If it changes into the state (OFF state) of leaving only the minute mirrors of DMD12 of the portion equivalent to the other pictures which should be displayed at the same time it turns on the light source 9 in this state, and reflecting none of other portions, in a view, only a picture besides **** shown in drawing 17 (b) will appear. Therefore, if the change of the on-off state of DMD12 and blink of the light source 9 are synchronized and this is repeated at high speed, can provide an observer with a screen overlay by the afterimage effect of eyes, but. If can move the center position of a microscope image suitably, and it will be made to relate to this, if the variable declination prism 20 is moved to an arrow direction in that case, and DMD12 is controlled suitably, the display size and the display position of other pictures can be changed suitably. It may be made to change into the state (ON state) of leaving only the minute mirrors of DMD12 of the portion equivalent to the other pictures which should be conversely displayed as a described method in the display of other pictures, and reflecting other portions of all the.

[0022]Drawing 18 (a), (b), and (c) is a figure for explaining an example of the picture yne display by this example. In this example, if the portion which DMD12 should carry out a picture yne display without turning on the light source 9 is made into an OFF state and the other portion is made into an ON state, in an observation visual field, the microscope which **** part shown in drawing 18 (a) lacked will appear. On the other hand, if the portion which should turn on the light source 9 and DMD12 should carry out a picture yne display is made into an ON state and the other portion is made into an OFF state, into an observation visual field, a picture yne indication only of the picture besides **** shown in drawing 18 (b) will be given. Therefore, if the state by which it was shown in the state by which it was shown in drawing 18 (a), and drawing 18 (b) is repeated at high speed, the **** picture yne display shown in drawing 18 (c) by the afterimage effect of eyes may be provided, but. Under the present circumstances, if can move the center position of a shape of microscopic features suitably as it was shown in drawing 19 (a) and (b), when moving the variable declination prism 20 to the arrow direction suitably, and it is made to relate to this and DMD12 is controlled suitably, the display position and display size of other pictures can be changed suitably.

[0023]Working example 7 drawing 20 is an important section sectional view showing the 7th working example of this invention. The light which it replaced with DMD as an image display element, and the high reflective liquid crystal 17 was used, and was compounded by the optical-path composite member 4 is irradiated with this working example by the high reflective liquid crystal 17 via the polarization beam splitter 25, Although it differs from the 6th working example in that the catoptric light from the high reflective liquid crystal 17 was made to be led to the eyepiece 8 via said polarization beam splitter 25, since the operation and effect are the same as that of the 6th working example, explanation is omitted.

[0024]Working example 8 drawing 21 is an optical lineblock diagram showing the 8th working example of this invention. This working example differs from any working example as stated above also in adopting an eccentric variable power optical system, and the magnification of other pictures increasing according to the degree of penetration of the other pictures into the microscopic field, and having enabled it to put other pictures on a microscope image in same mind. Although the numerals L attached to number numerals point out the optical member for left eyes among a figure and R has pointed out the optical member for right eyes, respectively, Except for the reflecting direction of light flux, since composition and an operation are the same, the optical system for right and left eyes is made to explain composition and an operation only about the optical system for left eyes below, and to display only numerals about the optical system for right eyes, and omits explanation. As for a collimating lens, and 27L and 28L, an eccentric variable power optical system and 30L of a reflecting member and 29L are [26L] the prism as other picture inserting members. If the eccentric variable power optical system 29L is

changed [magnification], at the same time as it will change the size of an image, it also changes the center position of an image, and it is constituted so that movement to the arrow direction of the picture insertion prism 30L may be interlocked with and variable power may be performed. Namely, optic-axis OL of the eccentric variable power optical system 29L is in the moving face of the optic axis of the microscope image surface, When the other image projection magnifications in d2 and the highest twice are set [the distance between this optic-axis OL and the optic axis of other image observation systems in the minimum twice / the other image projection magnifications in d1 and the minimum twice] to beta 2 for the distance between beta 1, said optic-axis OL, and the optic axis of other image observation systems in the highest twice, It is constituted so that the conditions which become beta2/beta1=d2-/d1 may be fulfilled.

[0025]Since this example is constituted in this way, the light flux emitted from the image display element which comprises DMD12L or the high reflective liquid crystal 17, It is reflected by the mirror 14L, and afocal light flux is used with the collimating lens 26L, it is reflected by the reflecting members 27L and 28L, and you are made to enter into the eccentric variable power optical system 29L. The eccentric variable power optical system 29L changes the projecting magnification of other pictures with movement into the microscope image of the picture insertion prism 30L, and it was displayed on the image display element, and also it projects a picture on the same flat surface as a microscope. In this case, as the dashed line showed, when a part [the other picture insertion prism 30L / the microscopic field], make projecting magnification of other pictures small and the whole other pictures are seen in microscope observation, Variable power of the eccentric variable power optical system 29L is carried out so that other pictures may spread in the whole other picture insertion prism 30L, when the other picture insertion prism 30L is inserted to the limit so that it may be in agreement with the optic axis of a microscope image as the solid line showed.

[0026]Thus, since according to this example required picture information is obtained to see other pictures in detail again, without neither letting a microscope out of sight even when mainly working using a microscope image and seeing other pictures to reference, the efficiency of work can be raised. Since most microscope images will disappear if it becomes near the maximum of other pictures, it is good to photo a microscope image in this case, to make a microscope image small, and to display this in other pictures, but this method of presentation incorporates an endoscope image as other pictures, It is effective when using a microscope image, in order to check the position of an endoscope, although processed using the endoscope image. right and left -- since it is separate and also a picture can be displayed, if the microscope image which carried out stereoradiography is displayed, solid observation is possible, and solid observation also of the solid CT image and endoscope image which are similarly displayed on an image display element can be carried out.

[0027]Working example 9 drawing 22 is an important section perspective view showing the 9th working example of this invention. This working example differs from the 8th working example in having made it lead the other pictures for right and left eyes to the collimating lenses 26L and 26R for right and left eyes, respectively by the one image display element 31 and the reflecting member 32 of one sheet. Although there is an advantage which says that this working example can miniaturize a device, since other operation effects are the same on the 8th working example and parenchyma, the explanation about these is omitted. In this working example, it is required to determine beforehand the display posture of the other pictures which should be displayed on the image display element 31, and to place it in consideration of the rotation of image by the reflecting direction of the reflecting member 32.

[0028]Working example 10 drawing 23 is an optical lineblock diagram showing the 10th working example of this invention. By the reflecting member 32 of one sheet, this working example divides into right and left eyes one other pictures displayed on the image display element 31, reflects them, and differs from the 9th working example at the point constituted so that this might be led to the reflecting members 27L and 27R for right and left eyes via the one collimating lens 33, respectively. Although it is the same for the left and the right according to this working example and also there is the feature which says that the structure for observing a picture becomes easy, since other operation effects are the same in an 8th working example and parenchyma top, the explanation about these is omitted. Drawing 24 shows an example of the corporal vision image display element 34 which may be used instead of the picture element 31 in this example. This corporal vision image display element 34 comprises the lenticular lens 34b which it had by turns a portion (slash part) which displays the other pictures for right eyes, and a portion (white portion) which displays the other pictures for left eyes, and also has been arranged at the picture display surface 34a and its front face, It can be different by the right and left of a vertical field to the other picture display surfaces 34a on a field including a direction without the curvature of the lenticular lens 34b, and also a picture can be observed. Therefore, if this corporal vision image display element 34 is used, solid observation of other pictures will be attained.

[0029]Working example 11 drawing 25 is a figure showing the relation of the microscope image and other pictures within the microscopic field displayed by the 11th working example of this invention, (a) shows the state where (b) inserted the state where the other picture insertion prism 30L was inserted for a while into the microscopic field, to the limit into the microscopic field so that other pictures might be displayed on the central part of the microscopic field in this prism 30L, respectively. According to the insertion and detachment to the arrow direction of the other picture insertion prism 30L, this working example is the point which carries out scaling of the other pictures and displayed them electrically, and differs from both the 8th thru/or the 10th working example. That is, this working example has the feature at the point of having used electronic zoom for scaling of other pictures. In this case, if it is based on electronic zoom, and also the other picture insertion prism 30L is allocated and placed as the center of the microscopic field is on the line which the center of scaling of a picture moves, it will become easy to select a

user of a microscope image and other pictures. Supposing it can observe under a microscope when the magnification of electronic zoom is set to beta 4 from beta 3, and also the area of a picture changes from S3 to S4, if beta4/beta3=rootS4/the relation which becomes S3 is materialized, it will be required, and also adjustment with image magnification and the microscopic field will become good.

[0030]Although only the object for left eyes was explained above, the object for right eyes can be constituted similarly if needed, and it is not necessary to say that the corporal vision of an above-mentioned microscope image and other pictures can be carried out by that cause. When image formation is carried out within light flux common to right and left and also it enables it to observe a picture, an observer can see a picture with all the same observers also by plurality. In this case, if the corporal vision image display element 34 shown in drawing 24 is used, it will also become possible to change other pictures on either side and to carry out solid observation. However, since it becomes a specific direction that a picture besides a solid is observable, it was different for the four quarters practical, and also it is good to use the picture element which can display a picture. Therefore, the pixel of the vertical 2 width 2 is made into one group, a micro lens is arranged on the 4-pixel medial axis, a pixel is doubled with the focal plane of the micro lens, if it changed with positions of the group of each pixel and also a picture is displayed, it was different for the four quarters, and also a picture can be in sight. Therefore, in addition, if an image display element is used, two or more observers can observe a picture besides a solid by one other image display elements. In order to make other pictures legible, it is good to coincide the optic axis of the eyepiece 8, and the center of other pictures, but most microscopes disappear in the state. In that case, if the microscope image photoed within the microscope is reduced and it is made to display on the periphery within an observation visual field, the situation of a microscope observed face is known also in other image confirmation, and even when a problem occurs, it will become possible to cope with it promptly.

[0031]The optical lineblock diagram of an important section in which working example 12 drawing 26 shows the 12th working example of this invention, and drawing 27 are the left side views of drawing 26. This working example differs from any working example as stated above in microscope light flux and the light flux from an image display element carrying out direct entering on the same DMD via a respectively separate optical system, and having enabled it to observe a microscope image and other pictures. The reflecting member for right and left eyes, 36L, 37L;36R, and 37R among a figure 35L and 35R The image rotator for right and left eyes, The 3 times reflecting prism for right and left eyes, and 39L and 39R 38L and 38R DMD for right and left eyes, As for the image formation point for right and left eyes, 41L, 41R;42L, and 42R, the other picture image formation lenses for right and left eyes, and 44L and 44R of the reflecting member for right and left eyes, and 43L and 43R are [40L and 40R] the reflecting members for right and left eyes. Except for the point that the light flux from the object which penetrated the image formation lenses 5L and 5R is made to reflect the optical system for right and left eyes in a counter direction also in this working example by the reflecting members 35L and 35R, since composition and an operation are the same, An operation will be explained only about the optical system for left eyes below, and the operation about the optical system for right eyes omits explanation.

[0032]In this example, you are made to reflect right-angled by the reflecting member 35L, and the light which passed along the image formation lens 5L enters into the image rotators 36L and 37L, rotates an image 180 degrees, and erects an image. The light which emitted the image rotator 37L is emitted after being made to reflect 3 times within the prism 38L, and it enters into DMD39L, it is made to reflect it here, image formation of the objective image (microscope image) is carried out in the image formation point 40L, and magnified observation of this image is carried out via the eyepiece 8L. On the other hand, image formation of the light flux emitted from the image display element 31L is carried out to the back image formation point 40L afocal light flux was used with the collimating lens 26L, it was made to reflect by the reflecting members 41L and 42L, respectively, and you were made to reflect by DMD39L with the other picture image formation lenses 43L. It was obtained in this way, and also magnified observation of the picture may be carried out via the eyepiece 8L with a microscope image.

[0033]In this case, by controlling the reflecting direction of DMD39L, a microscope image and other pictures can change those displaying conditions so that it may illustrate to drawing 28. That is, as shown in drawing 28 (a) and (b), the other picture reflection ranges 45L can be changed within the reflection control range 46L of DMD39L, and the display magnification of other pictures is changed according to change of this range. Magnification and the relation of a display rectangle are good to make it said expression-of-relations beta4/beta3=rootS4/S3 materialized. Thus, according to this example, since a change of the displaying condition of a microscope image and other pictures can be made without moving a lens and prism, there is an advantage which says that structure becomes easy. The relation of the optic axis of the optical system in DMD39L comes to be shown in drawing 29. That is, when the voltage impressed to DMD39L is positive, the optic axis 47 of a microscope image serves as the line 48, and a reflective symmetrical line's corresponds with the optic axis 49 of the eyepiece 8L. If voltage impressed to DMD39L is made negative, a reflective symmetrical line turns into the line 50, and the optic axis 51 of other pictures is in agreement with the optic axis 49 of the eyepiece 8L. The portion displayed by the change of this voltage is changed.

[0034]Although it is necessary to observe with both eyes for a corporal vision, interpupillary-distance adjustment is required in that case. In this case, interpupillary-distance adjustment may be performed by making DMD39L, the eyepiece 8L, the reflecting members 42L and 44L, and the other picture image formation lenses 43L into one (portion surrounded with the dashed line in drawing 26), and moving this to the exit light shaft orientation of the reflecting member 38L. In this case, since the image formation point 40L of a microscope moves, in order to amend this, it is required only for the half of the movement magnitude of a portion to really [above-mentioned] move the

reflecting member 38L to that exit light shaft orientation. Since it is afocal light flux between the collimating lens 26L and the other picture image formation lenses 43L, a focal position does not move by interpupillary-distance adjustment between. Since an observer is enabled to take an easy posture according to this example, can also make an angle of inclination variable, but. For that purpose, by making the image rotators 36L and 37L into one, constitute this so that the incident light axis to the image rotator 36L can be rotated as the axis of rotation, and. What is necessary is to carry out other image light study systems to from the prism 38L to 8L at one, to constitute this so that the incident light axis to the prism 38L can be rotated as the axis of rotation, and just to constitute so that the former rotating part and the latter rotating part can be rotated at one-pair a rate two.

[0035]Even if various working example explained reflection type picture display elements, such as DMD and high reflective liquid crystal, above on the assumption that one sheet was used, but this is put in order in two or more sheet parallel and it uses, it is not necessary to say that the same effect can be acquired. The luminosity of the whole microscope, change of the lightness distribution within a view, etc. are simultaneous and easily controllable by controlling these reflection type picture display elements. In the above explanation, although premised on the stereoscopic microscope, especially the operating microscope, it is not necessary to say that this is only mere illustration, therefore this invention can be applied also to the vision observation optical system of binoculars, other microscopes, or an ocellus.

[0036]As explained above, the stereoscopic microscope of this invention has the following feature besides the feature indicated to Claims.

(1) In a microscope and the stereoscopic microscope which observes other pictures through the eyepiece of the same microscope, intercept the partial area of a microscope image, and display said other pictures, and. The stereoscopic microscope characterized by having changed the area of said intercepted field, and also having displayed on said intercepted field, and also making it change the size of a picture.

[0037](2) In a microscope and the stereoscopic microscope which observes other pictures through the eyepiece of the same microscope, intercept the partial area of a microscope image, and display said other pictures, and. The stereoscopic microscope which having been displayed on said intercepted field, and also making have made it the distance of the center of a picture and the center of said microscope image change.

[0038](3) the center of said microscope image is movable -- having made -- a stereoscopic microscope given in the above (2) characterized by things.

[0039](4) In the stereoscopic microscope which observes a microscope image and other pictures through the eyepiece of the same microscope, The display device and projection optical system which display said other pictures apart from a microscope optical system are established, and insert the other pictures of this projection optical system into the view of said microscope optical system, and also A picture inserting member, A stereoscopic microscope provided with the transportation device to which these other picture inserting members are moved in the optical path of said microscope optical system, and the variable power optical system established in said projection optical system.

[0040](5) A stereoscopic microscope given in the above (4) having arranged the optical member which moves the optic axis of this optical system into the optical path of said microscope optical system.

[0041](6) A stereoscopic microscope given in the above (4) characterized by the optic axis of said projection optical system combined by said optical-path coupling means being parallel to the optic axis of said microscope optical system, separating the optic axis and distance of this microscope optical system, and making it enter into said eyepiece.

[0042](7) A stereoscopic microscope given in the above (4) characterized by making it the position at which the optic axis of said projection optical system crosses said display device be one of different positions from the center of said display device.

[0043](8) A stereoscopic microscope given in the above (4), wherein said optical-path composite member has an optical deflection function.

[0044](9) In the stereoscopic microscope which observed the optical image and other pictures of the microscope through the eyepiece of the same microscope, A stereoscopic microscope provided with the display device which displays the optical-path composite member which leads the illumination light of the illumination-light study system provided apart from the optical system of a microscope, and this illumination-light study system to the optical path of said microscope optical system, said optical image arranged in the optical path of said microscope optical system, and other pictures.

[0045](10) In the stereoscopic microscope which observed the optical image and other pictures of the microscope through the eyepiece of the same microscope, A stereoscopic microscope, wherein the display device and projection optical system which display said other pictures apart from the optical system of a microscope are established, it has an optical-path composite member which combines the optical path of this projection optical system with the optical path of said microscope optical system and this optical-path composite member has an optical deflection function.

[0046]

[Effect of the Invention]Like ****, according to this invention, the display needs of a microscope image or other pictures of changing according to advance of an operation can be fulfilled, and ** can also provide the operating microscope which can provide a way person with other picture information without losing a microscope image required for an operation. According to this invention, with the method of presentation suitable for the characteristic of other pictures, it is legible and also the display within a view which can provide a picture can be provided.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a sectional view showing the basic constitution of the optical system of the optical operating microscope concerning this invention.
[Drawing 2]It is a fragmentary sectional view showing the modification of the optical system shown in drawing 1.
[Drawing 3]It is an important section sectional view of the 1st working example of this invention.
[Drawing 4]It is a diagram showing the penetration characteristic of an optical-path composite member of being used for the 1st working example.
[Drawing 5]It is a front view of the wavelength limiting filter used for the 1st working example.
[Drawing 6]It is a diagram showing the transmissivity characteristic of a wavelength limiting filter, and (a) is the transmissivity characteristic of other image display portions, and (b) is the transmissivity characteristic of a microscope image portion.
[Drawing 7]It is a diagram showing the luminescent characteristic of the light source used for the 1st working example.
[Drawing 8]It is an explanatory view showing an example of a display of the microscope image by the 1st working example, and other pictures.
[Drawing 9](a), (b), and (c) are based on the 1st working example, and also they are an explanatory view showing the display example from which a picture differs mutually.
[Drawing 10]It is an important section sectional view of the 2nd working example of this invention.
[Drawing 11]It is an important section sectional view of the 3rd working example of this invention.
[Drawing 12](a) and (b) are based on the variable power operation in the 3rd working example, and also they are an explanatory view showing the situation of change of a picture.
[Drawing 13]It is an important section sectional view of the 4th working example of this invention.
[Drawing 14]It is an important section sectional view of the 5th working example of this invention.
[Drawing 15](a) and (b) are the explanatory views showing the situation of movement of the microscope image in the 5th working example, and other pictures.
[Drawing 16]It is an important section sectional view of the 6th working example of this invention.
[Drawing 17](a) and (b) are the explanatory views showing an example of change of the displaying condition of the microscope image by the 6th working example, and other pictures.
[Drawing 18](a), (b), and (c) are the explanatory views showing other examples of change of the displaying condition of the microscope image by the 6th working example, and other pictures.
[Drawing 19](a) and (b) are based on the 6th working example, and also they are an explanatory view showing the situation of movement of the center position of the microscope image accompanying movement of a picture.
[Drawing 20]It is an important section sectional view of the 7th working example of this invention.
[Drawing 21]It is an important section sectional view of the 8th working example of this invention.
[Drawing 22]It is an important section perspective view of the 9th working example of this invention.
[Drawing 23]It is an important section sectional view of the 10th working example of this invention.
[Drawing 24]It is a sectional view showing an example of a corporal vision image display element.
[Drawing 25](a) and (b) are the explanatory views showing the situation of movement of the microscope image displayed by the 11th working example of this invention, and other pictures.
[Drawing 26]It is an important section sectional view of the 12th working example of this invention.
[Drawing 27]It is a left side view of drawing 26.
[Drawing 28]It is an explanatory view showing the situation of movement of the microscope image by the 12th working example, and other pictures.
[Drawing 29]It is an explanatory view showing the relation of the angle of reflection of each optic axis of the microscope image by DMD, and other pictures to the 12th working example.
[Drawing 30]It is a figure showing the binoculars cylinder part in the conventional optical operating microscope, and (a) is an appearance perspective view and (b) is a sectional view.
[Drawing 31]It is an explanatory view showing an example of a display of other pictures with the microscope image by the conventional operating microscope system in some numbers.
[Drawing 32]It is an explanatory view showing other examples of a display of other pictures with the microscope image by the conventional operating microscope system in some numbers.
[Description of Notations]

1 Object lens
2 Zoom lens
3 Diaphragm
4 Optical-path composite member
5, 5L, 5R, 18 image formation lenses
6, 36L, 36R, 37L, and 37R Image rotator
7 Wavelength limiting filter
8 Eyepiece
9 Light source
10 Optical diffusion board
11, 26L, 26R, and 33 Collimating lens
12, 39L, 39R DMD (image display element)
13 Projection lens
14 and 24 Mirror
15 Condenser
16 Polarization mirror
17 High reflective liquid crystal (image display element)
19 Zoom optical system
20 Variable declination prism
21 Driving means
22 Drive control means
23, 38L, and 38R Prism
25 Polarization beam splitter
27L, 27R, 28L, 28R,32,35L, and 35R, 41L, 41R, 42L, 42R, 44L and 44R Reflecting member
29L and 29R Eccentric variable power optical system
30L and 30R Other picture insertion prism
31 Image display element
34 Corporal vision image display element
40L and 40R Image formation point
43L and 43R Other picture image formation lenses
45L and 45R Other picture reflection ranges
46L and 46R Reflection control range
47, 49, 51, OL, and OR Optic axis
48 and 50 Line equivalent to the normal of a mirror
S Observation object
I Microscope image

[Translation done.]

CORRECTION OR AMENDMENT

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[Amendment 1]
[Document to be Amended]Description
[Item(s) to be Amended]Claims
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[The contents of amendment]
[Claim(s)]
[Claim 1]A stereoscopic microscope which intercept a partial area of a shape of microscopic features, and said other pictures are displayed in a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, and is characterized by making it change area of said intercepted field.
[Claim 2]A stereoscopic microscope characterized by having displayed on said intercepted field, and also having intercepted a partial area of a shape of microscopic features, and having displayed said other pictures in a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, and making it change a size of a picture.
[Claim 3]A stereoscopic microscope comprising:
A display device and a projection optical system as which an optical system of a microscope displays said other pictures independently in a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope are established, and other pictures of this projection optical system are inserted into a view of said microscope optical system, and also it is a picture inserting member.
A moving mechanism to which these other picture inserting members are moved in an optical path of said microscope optical system.

[Claim 4]In a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, A stereoscopic microscope, wherein a display device and a projection optical system which display said other pictures apart from an optical system of a microscope were established, it had an optical-path composite member which combines an optical path of this projection optical system with an optical path of said microscope optical system and said projection optical system is provided with a variable power optical system.
[Claim 5]In a microscope and a stereoscopic microscope which observes other pictures through an eyepiece of the same microscope, intercept a partial area of a microscope image, and display said other pictures, and. A stereoscopic microscope characterized by having changed area of said intercepted field, and also having displayed on said intercepted field, and also making it change a size of a picture.
[Claim 6]In a microscope and a stereoscopic microscope which observes other pictures through an eyepiece of the same microscope, intercept a partial area of a microscope image, and display said other pictures, and. A

stereoscopic microscope which having been displayed on said intercepted field, and also making have made it distance of the center of a picture and the center of said microscope image change.
[Claim 7]The stereoscopic microscope according to claim 6, wherein the center of said microscope image carries out as [be / movable].
[Claim 8]A stereoscopic microscope which observes a microscope image and other pictures through an eyepiece of the same microscope, comprising:
A display device and a projection optical system which display said other pictures apart from a microscope optical system are established, and other pictures of this projection optical system are inserted into a view of said microscope optical system, and also it is a picture inserting member.
A transportation device to which these other picture inserting members are moved in an optical path of said microscope optical system.
A variable power optical system established in said projection optical system.

[Claim 9]The stereoscopic microscope according to claim 8 having arranged an optical member which moves an optic axis of this optical system into an optical path of said microscope optical system.
[Claim 10]The stereoscopic microscope according to claim 8 characterized by an optic axis of said projection optical system combined by said optical-path coupling means being parallel to an optic axis of said microscope optical system, separating an optic axis and distance of this microscope optical system, and making it enter into said eyepiece.
[Claim 11]The stereoscopic microscope according to claim 8 characterized by making it a position at which an optic axis of said projection optical system crosses said display device be one of different positions from the center of said display device.
[Claim 12]The stereoscopic microscope according to claim 8 with which said optical-path composite member is characterized by having an optical deflection function.
[Claim 13]A stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, comprising:
An optical-path composite member which leads illumination light of an illumination-light study system provided apart from an optical system of a microscope, and this illumination-light study system to an optical path of said microscope optical system.
A display device which displays said optical image arranged in an optical path of said microscope optical system, and other pictures.

[Claim 14]In a stereoscopic microscope which observed an optical image and other pictures of a microscope through an eyepiece of the same microscope, A stereoscopic microscope, wherein a display device and a projection optical system which display said other pictures apart from an optical system of a microscope are established, it has an optical-path composite member which combines an optical path of this projection optical system with an optical path of said microscope optical system and this optical-path composite member has an optical deflection function.
[Amendment 2]
[Document to be Amended]Description
[Item(s) to be Amended]0009
[Method of Amendment]Change
[The contents of amendment]
[0009]
In the stereoscopic microscope with which the stereoscopic microscope by this invention observed the optical image and other pictures of the microscope through the eyepiece of the same microscope, It is characterized by having established the display device and projection optical system which display said other pictures apart from the optical system of a microscope, having had the optical-path composite member which combines the optical path of this projection optical system with the optical path of said microscope optical system, and providing said projection optical system with a variable power optical system.
In a microscope and the stereoscopic microscope which observes other pictures through the eyepiece of the same microscope, the stereoscopic microscope by this invention intercepts the partial area of a microscope image, and displays said other pictures, and. Change the area of said intercepted field, and also it displays on said intercepted field, and also is characterized by making it change the size of a picture.
In a microscope and the stereoscopic microscope which observes other pictures through the eyepiece of the same microscope, the stereoscopic microscope by this invention intercepts the partial area of a microscope image, and displays said other pictures, and. It is displayed on said intercepted field, and also is characterized by being made to have made it the distance of the center of a picture and the center of said microscope image change.
The stereoscopic microscope by this invention is characterized by the center of said microscope image carrying out as [be / movable].
In the stereoscopic microscope with which the stereoscopic microscope by this invention observes a microscope image and other pictures through the eyepiece of the same microscope, The display device and projection optical system which display said other pictures apart from a microscope optical system are established, and insert the other pictures of this projection optical system into the view of said microscope optical system, and also A picture inserting member, It is characterized by having a transportation device to which these other picture inserting members are moved in the optical path of said microscope optical system, and the variable power optical system

established in said projection optical system.
The stereoscopic microscope by this invention is characterized by having arranged the optical member which moves the optic axis of this optical system into the optical path of said microscope optical system.
The optic axis of said projection optical system in which the stereoscopic microscope by this invention was combined by said optical-path coupling means is characterized by being parallel to the optic axis of said microscope optical system, separating the optic axis and distance of this microscope optical system, and making it enter into said eyepiece.
The stereoscopic microscope by this invention is characterized by making it the position at which the optic axis of said projection optical system crosses said display device be one of different positions from the center of said display device.
The stereoscopic microscope by this invention is characterized by said optical-path composite member having an optical deflection function.
In the stereoscopic microscope with which the stereoscopic microscope by this invention observed the optical image and other pictures of the microscope through the eyepiece of the same microscope, It is characterized by having a display device which displays the optical-path composite member which leads the illumination light of the illumination-light study system provided apart from the optical system of a microscope, and this illumination-light study system to the optical path of said microscope optical system, said optical image arranged in the optical path of said microscope optical system, and other pictures.
In the stereoscopic microscope with which the stereoscopic microscope by this invention observed the optical image and other pictures of the microscope through the eyepiece of the same microscope, The display device and projection optical system which display said other pictures apart from the optical system of a microscope are established, and it has an optical-path composite member which combines the optical path of this projection optical system with the optical path of said microscope optical system, and is characterized by this optical-path composite member having an optical deflection function.

[Translation done.]